CLAIMS

What is claimed is:

1. An apparatus for introducing deadspace into a breathing circuit, comprising:

a primary expiratory pathway through the breathing circuit;

a deadspace portion of the breathing circuit located to receive gases exhaled by a patient upon positioning the breathing circuit in communication with an airway of the patient, said deadspace portion communicating with said primary expiratory pathway at least one junction thereof with said primary expiratory pathway;

a flow restrictor positioned along said primary expiratory pathway, downstream from said at least one junction; and

a two-way valve located and positionable so as to, along with said flow restrictor, prevent gases from flowing into said deadspace portion and allow gases to flow into said deadspace portion.

2. The apparatus of claim 1, wherein said deadspace portion comprises at least a volume adjustable section.

3. The apparatus of claim 2, wherein said volume adjustable section is length expandable and length contractible.

4. A method for estimating the partial pressure of carbon dioxide in the alveolar blood (P_ACO_2) of an individual, comprising:

calculating a concentration of carbon dioxide in a parallel deadspace (PDS_{CO_2}) of an airway of the individual on a breath-by-breath basis; and

determining a partial pressure of end tidal carbon dioxide ($PetCO_2$) of the individual.

5. The method of claim 4, further comprising determining a perfusion ratio (r).

6. The method of claim 5, wherein:

$P_ACO_2 = [PetCO_2 - (1 - r) \times PDS_{CO_2}]/r$.

7. The method of claim 4, wherein said calculating comprises:

determining a mixed inspired volume of carbon dioxide ($ViCO_2$) inhaled by the individual;

at least estimating an airway deadspace of the individual;

determining a partial pressure of end tidal carbon dioxide ($PetCO_2$) of a previous breath of the individual; and

determining a tidal volume (V_t) of the individual's breathing.

8. The method of claim 7, wherein said calculating further comprises:

at least estimating a functional residual capacity (FRC) of alveoli of the individual's lungs.

9. The method of claim 8, wherein

$$PDS_{CO_2}(n) = \{[FRC/(FRC + V_t)] \times PDS_{CO_2}(n-1)\} + (\{[ViCO_2 + (deadspace \times PetCO_2(n-1))]/V_t\} \times [V_t/(V_t + FRC)]),$$

where (n) indicates a parameter for a current breath and (n-1) represents a parameter for an immediately preceding breath.

10. A method for estimating the cardiac output of an individual, comprising:

determining a carbon dioxide elimination (VCO_2) of the individual for a before re-breathing period and for a during re-breathing period;

calculating a carbon dioxide elimination difference between said carbon dioxide elimination of said before re-breathing period and said carbon dioxide elimination of said during re-breathing period;

estimating a partial pressure of carbon dioxide in alveolar blood ($PACO_2$) of the individual for said before re-breathing period and for said during re-breathing period respectively based on partial pressure of end tidal carbon dioxide ($PetCO_2$) measurements of the individual during said before re-breathing period and during said during re-breathing period;

converting each estimation of said partial pressure of carbon dioxide in alveolar blood to a carbon dioxide content (C_{CO2});

calculating a carbon dioxide content difference between said carbon dioxide content of said before re-breathing period and said carbon dioxide content of said during re-breathing period; and

dividing said carbon dioxide elimination difference by said carbon dioxide content difference.